

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) A mobile device with an input unit, a display unit, a memory unit and a central control unit, the mobile device comprising:

a biomedical signal measurement module ~~for detecting~~ that detects biomedical signals from a user's body, ~~classifying~~ and classifies the detected biomedical signals by respective signals and outputting the classified signals, ~~and correcting user-to-user variation based on values of the detected biomedical signals being within a range of respective threshold levels; and~~

a health care module ~~for analyzing~~ that analyzes an emotional state and physical condition of the user based on the classified signals input from the biomedical signal measurement module and physical information of the user, the health care module comprising:

an emotional state analysis unit, including a feature analysis unit ~~for extracting~~ that extracts feature values of the classified biomedical signals input from the biomedical signal measurement module, a subtracter unit ~~for obtaining~~ that obtains differences between the extracted feature values from the feature analysis unit and predetermined feature values, and a support vector machine (SVM) unit ~~for classifying~~ that classifies the user's emotional state by respective emotions in accordance with the differences of the feature values obtained by the subtracter unit, and

a physical condition analysis unit ~~for analyzing~~ that analyzes the user's physical condition based on the classified biomedical signals input from the biomedical signal measurement module and the user's physical information.

2. (Original) The mobile device as claimed in claim 1, wherein the biomedical signal measurement module comprises:

a sensor unit for detecting one or more biomedical signals from the user's body; and

a sensor control unit for controlling the sensor unit, classifying the biomedical signals input from the sensor unit by the respective biomedical signals and outputting the classified biomedical signals.

3. (Original) The mobile device as claimed in claim 2, wherein the sensor unit comprises a heart rate sensor for detecting heartbeat-related biomedical signals.

4. (Previously Presented) The mobile device as claimed in claim 3, wherein the biomedical signals of heartbeat are photoelectric pulse plethysmograph (PPG) signals.

5. (Original) The mobile device as claimed in claim 2, wherein the sensor unit comprises a skin temperature sensor for detecting skin temperature-related biomedical signals.

6. (Previously Presented) The mobile device as claimed in claim 2, wherein the biomedical signals of skin temperature are skin temperature (SKT) signals.

7. (Original) The mobile device as claimed in claim 2, wherein the sensor unit comprises a skin resistance sensor for detecting skin resistance-related biomedical signals.

8. (Previously Presented) The mobile device as claimed in claim 7, wherein the biomedical signals of skin resistance are electrodermal activity (EDA) signals.

9. (Original) The mobile device as claimed in claim 2, wherein the sensor unit comprises a body fat sensor for measuring body impedance required for calculation of a body fat percentage.

10. (Previously Presented) The mobile device as claimed in claim 2, wherein the sensor unit comprises at least one of a heart rate sensor, skin temperature sensor, skin resistance sensor and body fat sensor, and the sensor unit further comprises a filter for filtering the detected biomedical signals and an amplifier for amplifying the filtered biomedical signals.

11. (Previously Presented) The mobile device as claimed in claim 2, wherein the sensor unit comprises at least one of heart rate sensor, skin temperature sensor, skin resistance sensor and body fat sensor and wherein the sensor unit is installed at a position on the mobile device with which user's hand comes into contact when the user holds the mobile device.

12. (Currently Amended) The mobile device as claimed in claim 2, wherein the sensor control unit corrects user-to-user variation of the biomedical signals ~~which~~ that are output from the sensor unit.

13. (Original) The mobile device as claimed in claim 1, wherein the biomedical signal measurement module is constructed to be detachably coupled to the mobile device.

14. (Original) The mobile device as claimed in claim 13, wherein the biomedical signal measurement module is constructed in the form of a case capable of accommodating the mobile device therein.

15-16. (Canceled)

17. (Previously Presented) The mobile device as claimed in claim 1, wherein the feature analysis unit comprises:

a heartbeat analysis unit for receiving photoelectric pulse plethysmograph (PPG) signals to detect heartbeat signals and extracting feature values related to the heartbeat signals;

a skin conductive response analysis unit for receiving electrodermal activity (EDA) signals and extracting feature values related to a skin conductive response;
and

a skin temperature analysis unit for receiving skin temperature (SKT) signals and extracting feature values related to skin temperature.

18. (Original) The mobile device as claimed in claim 17, wherein the heartbeat analysis unit comprises:

a heartbeat detection unit for receiving the PPG signals to detect the heartbeat signals and converting the detected heartbeat signals into time series signals of heart rate variability;

a spectrum analysis unit for analyzing a spectrum of the heartbeat signals in response to the time series signals of the heart rate variability; and

a mean/standard deviation calculation unit for calculating a mean value and standard deviation value of the heartbeat signals in response to the time series signals of the heart rate variability.

19. (Original) The mobile device as claimed in claim 18, wherein the heartbeat detection unit comprises:

a band pass filter for extracting signals falling within a specific band of the PPG signals;

a median filter for removing noise existing in the filtering results of the band pass filter;

an adder for calculating a difference between the filtering results of both the band pass filter and the median filter by adding a reciprocal number of the filtering result of the median filter to the filtering result of the band pass filter;

a matched filter for extracting the heartbeat signals from output signals of the adder; and

a zero clipper for performing zero clipping for the heartbeat signals.

20. (Previously Presented) The mobile device as claimed in claim 1, wherein the subtracter unit uses feature values of a normal emotional state for the user as the predetermined feature values on which the user's emotional state is determined.

21. (Previously Presented) The mobile device as claimed in claim 1, wherein the SVM unit comprises:

an SVM classifier for classifying the user's emotional state into a plurality of emotions by analyzing the differences of the features values obtained from the subtracter unit; and

an emotional state determination unit for selecting values related to a specific emotion among values of the plurality of emotions classified by the SVM classifier and calculating and outputting an index and a level for the specific emotion.

22. (Original) The mobile device as claimed in claim 21, wherein the SVM unit further comprises:

a database for storing a plurality of pieces of emotion data for training the SVM classifier, and trained results of the SVM classifier based on the emotion data.

23. (Previously Presented) The mobile device as claimed in claim 1, wherein the physical condition analysis unit comprises:

a body fat percentage calculation unit for calculating body fat percentage based on a body impedance value detected by the biomedical signal measurement module and user's height, weight, age and sex; and

a calorie consumption calculation unit for calculating calorie consumption due to exercise based on average heart rates and body fat percentages before/after exercise detected by the biomedical signal measurement module.

24. (Currently Amended) A health care method using a mobile device, comprising the steps of:

detecting biomedical signals from a user's body;
classifying the detected biomedical signals by respective signals;
analyzing an emotional state of the user by extracting a plurality of feature values from the classified biomedical signals, calculating differences between the extracted feature values and predetermined feature values, and classifying the user's emotional state by respective emotions based on support vector machine (SVM) classification in accordance with the calculated differences of the feature values; and

analyzing a physical condition of the user based on the classified signals and user's physical information; and

~~correcting user-to-user variation of the biomedical signals detected from the user's body based on values of the detected biomedical signals being within a range of respective threshold levels.~~

25. (Previously Presented) The method as claimed in claim 24, further comprising the steps of:

selecting, by the user, a health care menu on a mobile device with a biomedical signal measurement module; and

if the user selects emotional state measurement, activating the biomedical signal measurement module to detect the biomedical signal in the mobile device.

26. (Canceled)

27. (Previously Presented) The method as claimed in claim 24, further comprising the steps of:

classifying the user's emotional state into a plurality of emotions by analyzing the differences of the features values; and

selecting values related to an emotion selected among the classified emotions, calculating an emotional state index and level for the selected emotion, and displaying the calculated emotional state index and level on a display unit of the mobile device.

28. (Original) The method as claimed in claim 24, wherein the biomedical signals detected from the user's body include biomedical signals of heartbeat.

29. (Previously Presented) The method as claimed in claim 28, wherein the biomedical signals of heartbeat are photoelectric pulse plethysmograph (PPG) signals.

30. (Original) The method as claimed in claim 24, wherein the biomedical signals detected from the user's body include skin temperature-related biomedical signals.

31. (Previously Presented) The method as claimed in claim 30, wherein the biomedical signals of skin temperature are skin temperature (SKT) signals.

32. (Original) The method as claimed in claim 24, wherein the biomedical signals detected from the user's body include skin resistance-related biomedical signals.

33. (Previously Presented) The method as claimed in claim 32, wherein the biomedical signals of skin resistance are electrodermal activity (EDA) signals.

34. (Original) The method as claimed in claim 24, wherein the biomedical signals detected from the user's body are filtered by a filter and then amplified by an amplifier.

35. (Canceled)

36. (Currently Amended) The method as claimed in claim 24, ~~wherein the step of~~ further comprising the step of correcting user-to-user variation of the biomedical signals detected from the user's body, the correcting the user-to-user variation ~~of the biomedical signals comprises the steps of~~ comprising:

determining whether the user's body is in contact with the biomedical signal measurement module;

if it is determined that the user's body is in contact with the biomedical signal measurement module, determining whether the correction of the user-to-user variances of the detected biomedical signals is required;

if it is determined that the correction of the user-to-user variances of the detected biomedical signals is required, checking whether values of the detected biomedical signals are above a maximum limit level and decreasing a gain of an amplifier if the values of the detected biomedical signals are above the maximum limit level; and

if the values of the detected biomedical signals are equal to or less than the maximum limit level, checking whether the values of the detected biomedical signals are equal to or less than a minimum limit level and increasing the gain of the amplifier if the values of the detected biomedical signals are equal to or less than the minimum limit level.

37. (Previously Presented) The method as claimed in claim 24, wherein the step of analyzing the biomedical signals and extracting the plurality of feature values to be used for determining the user's emotional state comprises the steps of:

receiving photoelectric pulse plethysmograph (PPG) signals to detect heartbeat signals and extracting feature values related to the heartbeat signals;

receiving electrodermal activity (EDA) signals and extracting feature values related to a skin conductive response; and

receiving skin temperature (SKT) signals and extracting feature values related to skin temperature.

38. (Previously Presented) The method as claimed in claim 24, wherein the predetermined feature values on which the user's emotional state is determined are feature values for a normal emotional state of the user.

39. (Previously Presented) The method as claimed in claim 24, wherein the step of classifying the user's emotional state by the respective emotions uses an SVM classifier that classifies the user's emotional state into a plurality of emotions based on a statistical learning theory.

40. (Original) The method as claimed in claim 25, wherein the biomedical signal measurement module is configured to be detachably coupled to the mobile device.

41. (Original) The method as claimed in claim 40, wherein the biomedical signal measurement module is constructed in the form of a case capable of accommodating the mobile device therein.

42. (Original) The method as claimed in claim 25, further comprising the steps of, if the user selects body fat measurement,

activating a body fat sensor in the biomedical signal measurement module mounted to the mobile device;

measuring body impedance from the user's body by the body fat sensor; and
calculating a body fat percentage of the user's body based on the measured impedance and user's physical information and displaying the calculated the body fat percentage on the display unit.

43. (Original) The method as claimed in claim 25, further comprising the steps of, if the user selects calorie consumption measurement,

activating a heart rate sensor and a body fat sensor in the biomedical signal measurement module;

measuring heartbeat signals and body impedance before/after exercise from the user's body by the heart rate sensor and the body fat sensor; and

analyzing the heartbeat signals and the body impedance before/after exercise to calculate average heart rates and body fat percentages before/after exercise, calculating calorie consumption due to exercise based on the calculated average heart rates and body fat percentages before/after exercise, exercise time, and user's physical information, and displaying the calculated calorie consumption on the display unit.

44. (Previously Presented) The method as claimed in claim 25, further comprising the step of, if the user selects history management, displaying measurement results according to respective desired terms on the display unit.